1. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 8x^3 + 14x^2 - 63x + 36$$

A. $z_1 \in [-3.28, -2.73]$, $z_2 \in [-0.41, -0.35]$, and $z_3 \in [3.73, 4.24]$

B. $z_1 \in [-4.4, -3.98]$, $z_2 \in [0.74, 0.77]$, and $z_3 \in [1.49, 1.67]$

C. $z_1 \in [-1.44, -1.26]$, $z_2 \in [-0.71, -0.63]$, and $z_3 \in [3.73, 4.24]$

D. $z_1 \in [-1.57, -1.35]$, $z_2 \in [-0.77, -0.71]$, and $z_3 \in [3.73, 4.24]$

E. $z_1 \in [-4.4, -3.98]$, $z_2 \in [0.62, 0.69]$, and $z_3 \in [0.96, 1.36]$

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2. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 - 56x - 51}{x - 3}$$

A. $a \in [8, 12], b \in [19, 29], c \in [13, 17]$, and $r \in [-4, 2]$.

B. $a \in [23, 29], b \in [-72, -69], c \in [160, 162]$, and $r \in [-533, -529]$.

C. $a \in [23, 29], b \in [69, 79], c \in [160, 162]$, and $r \in [426, 431]$.

D. $a \in [8, 12], b \in [11, 19], c \in [-24, -23]$, and $r \in [-99, -95]$.

E. $a \in [8, 12], b \in [-24, -19], c \in [13, 17]$, and $r \in [-99, -95]$.

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3. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 52x^2 - 48x - 66}{x + 4}$$

A. $a \in [7, 17]$, $b \in [-25, -21]$, $c \in [63, 72]$, and $r \in [-404, -400]$.

B. $a \in [-68, -58]$, $b \in [290, 297]$, $c \in [-1220, -1214]$, and $r \in [4796, 4800]$.

C. $a \in [7, 17]$, $b \in [-13, -4]$, $c \in [-17, -14]$, and $r \in [-4, 0]$.

D. $a \in [7, 17]$, $b \in [107, 113]$, $c \in [400, 403]$, and $r \in [1534, 1539]$.

E. $a \in [-68, -58]$, $b \in [-192, -185]$, $c \in [-800, -796]$, and $r \in [-3270, -3265]$.

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4. Factor the polynomial below completely, knowing that $x+4$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 12x^4 + 59x^3 - 1x^2 - 230x - 200$$

A. $z_1 \in [-4.1, -3.6]$, $z_2 \in [-0.85, -0.64], z_3 \in [-0.88, -0.5]$, and $z_4 \in [0.6, 3]$

B. $z_1 \in [-4.1, -3.6]$, $z_2 \in [-1.72, -1.62], z_3 \in [-1.32, -1.21]$, and $z_4 \in [0.6, 3]$

C. $z_1 \in [-3, -0.6]$, $z_2 \in [0.49, 0.85], z_3 \in [0.67, 1.33]$, and $z_4 \in [2.3, 4.6]$

D. $z_1 \in [-3, -0.6]$, $z_2 \in [1.13, 1.51], z_3 \in [1.35, 1.96]$, and $z_4 \in [2.3, 4.6]$

E. $z_1 \in [-3, -0.6]$, $z_2 \in [0.4, 0.55], z_3 \in [3.9, 4.15]$, and $z_4 \in [4.3, 5.8]$

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5. Factor the polynomial below completely, knowing that $x-2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 4x^4 - 24x^3 + 29x^2 + 51x - 90$$

A. $z_1 \in [-5.77, -4.75]$, $z_2 \in [-3.17, -2.57], z_3 \in [-2.16, -1.25]$, and $z_4 \in [0.7, 0.83]$

B. $z_1 \in [-1.04, 0.01]$, $z_2 \in [-0.19, 1.44], z_3 \in [1.27, 2.41]$, and $z_4 \in [2.99, 3.06]$

C. $z_1 \in [-3.2, -2.58]$, $z_2 \in [-2.17, -1.53], z_3 \in [-0.87, 0.52]$, and $z_4 \in [0.65, 0.68]$

D. $z_1 \in [-1.67, -0.78]$, $z_2 \in [1.55, 2.52], z_3 \in [2.15, 2.77]$, and $z_4 \in [2.99, 3.06]$

E. $z_1 \in [-3.2, -2.58]$, $z_2 \in [-2.62, -2.43]$, $z_3 \in [-2.16, -1.25]$, and $z_4 \in [1.46, 1.55]$

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6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 + 32x^2 - 8x - 27}{x + 4}$$

A. $a \in [6, 21]$, $b \in [64, 68]$, $c \in [245, 251]$, and $r \in [964, 969]$.

B. $a \in [6, 21]$, $b \in [-9, -4]$, $c \in [28, 36]$, and $r \in [-190, -185]$.

C. $a \in [6, 21]$, $b \in [-3, 7]$, $c \in [-10, -1]$, and $r \in [3, 8]$.

D. $a \in [-35, -28]$, $b \in [159, 163]$, $c \in [-648, -644]$, and $r \in [2563, 2566]$.

E. $a \in [-35, -28]$, $b \in [-101, -90]$, $c \in [-394, -391]$, and $r \in [-1596, -1594]$.

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7. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^3 - 54x^2 + 35x + 50$$

A. $z_1 \in [-1, 0.1]$, $z_2 \in [1.58, 1.68]$, and $z_3 \in [4.86, 5.29]$

B. $z_1 \in [-5.1, -4.7]$, $z_2 \in [-1.67, -1.59]$, and $z_3 \in [0.38, 1]$

C. $z_1 \in [-5.1, -4.7]$, $z_2 \in [-0.61, -0.57]$, and $z_3 \in [0.88, 1.74]$

D. $z_1 \in [-5.1, -4.7]$, $z_2 \in [-0.58, -0.54]$, and $z_3 \in [1.65, 2.08]$

E. $z_1 \in [-2, -1.4]$, $z_2 \in [0.57, 0.61]$, and $z_3 \in [4.86, 5.29]$

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8. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 2x^3 + 3x^2 + 7x + 6$$

A. All combinations of: $\dfrac{\pm 1, \pm 2}{\pm 1, \pm 2, \pm 3, \pm 6}$

B. $\pm 1, \pm 2$

C. $\pm 1, \pm 2, \pm 3, \pm 6$

D. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 2}$

E. There is no formula or theorem that tells us all possible Integer roots.

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9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 - 65x^2 + 84}{x - 4}$$

A. $a \in [13, 16], b \in [-20, -10], c \in [-61, -59]$, and $r \in [-100, -95]$.

B. $a \in [57, 64], b \in [173, 179], c \in [699, 703]$, and $r \in [2883, 2885]$.

C. $a \in [13, 16], b \in [-7, 0], c \in [-21, -17]$, and $r \in [3, 5]$.

D. $a \in [13, 16], b \in [-127, -116], c \in [497, 510]$, and $r \in [-1921, -1914]$.

E. $a \in [57, 64], b \in [-308, -301], c \in [1213, 1228]$, and $r \in [-4796, -4793]$.

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10. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 5x^3 + 3x^2 + 2x + 6$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 5}$

B. $\pm 1, \pm 5$

C. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 2, \pm 3, \pm 6}$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Rational roots.
